Jointly designed by PH Tool and Holloway NDT, this set of three "Extended Range Variable Wall" (ERVW) Piping Calibration Blocks with side-drilled holes has been developed for calibrations in the axial direction for examination of circumferential butt welds.

ERVW® Piping Calibration Blocks

ERVW Piping Calibration Blocks ("Extended Range Variable Wall")

Large (12" to 20")

Medium (6" to 10")

Small (3" to 5")

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HOLLOWAY NDT & ENGINEERING INC

Set Details:

- Small Block (3-5") is 7 inches long, and weighs 3 lbs.
- Medium Block (6-10") is 10 inches long, and weighs 7 lbs.
- Large Block (12-20") is 16 inches long, and weighs 20 lbs.
- Surface Finish: Media-blasted to 125 Ra to simulate inspection conditions
- Materials: Most commonly requested in carbon or stainless steel, but other alloys available upon request
- Machine-engraved transducer positioning marks to aid in functionality and maximize signal from SDHs.
- Each step is engraved with pipe sizes (OD / Wall) covered. Block end is marked with serial number and alloy.

Inspection Sizes Covered by Set of 3 ERVW Blocks: Small - 12; Medium - 29; Large - 55; Total - 96

NPS (in.)	O.D. (in.)	20	30	STD	40	60	XS	80	100	120	140	160	XXS
3	3.500	-	0.188	0.216	0.216	-	0.300	0.300	-	-	-	0.438	0.600
4	4.500	-	0.188	0.237	0.237	-	0.337	0.337	-	0.438	-	0.531	0.674
5	5.563	-	-	0.258	0.258	-	0.375	0.375	-	0.500	-	0.625	0.750
6	6.625	-	-	0.280	0.280	-	0.432	0.432	-	0.562	-	0.719	0.864
8	8.625	0.250	0.277	0.322	0.322	0.406	0.500	0.500	0.594	0.719	0.812	0.906	0.875
10	10.750	0.250	0.307	0.365	0.365	0.500	0.500	0.594	0.719	0.844	1.000	1.125	1.000
12	12.750	0.250	0.330	0.375	0.406	0.562	0.500	0.688	0.844	1.000	1.125	1.312	1.000
14	14.000	0.312	0.375	0.375	0.438	0.594	0.500	0.750	0.938	1.094	1.250	1.406	-
16	16.000	0.312	0.375	0.375	0.500	0.656	0.500	0.844	1.031	1.219	1.438	1.594	-
18	18.000	0.312	0.438	0.375	0.562	0.750	0.500	0.938	1.156	1.375	1.562	1.781	-
20	20.000	0.375	0.500	0.375	0.594	0.812	0.500	1.031	1.281	1.500	1.750	1.969	-

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ERVW® Piping Calibration Blocks

Design and development of the new blocks was performed concurrently with simulations using CIVA software. The basic design remains compliant with ASME Sec V Article 4, Fig. T-434.3-2 requirements, but with features including varying thickness steps on a single block, and specific reference reflector locations to optimize size and functionality. The majority of piping examinations are performed on circumferential welds. As a result, the reflectors included on these blocks are oriented in the circumferential direction, for calibration in the axial direction. Side-drilled holes were selected as the reference reflector type based on enhanced sensitivity vs. notches at a variety of angles, making them ideal targets for PAUT calibrations.

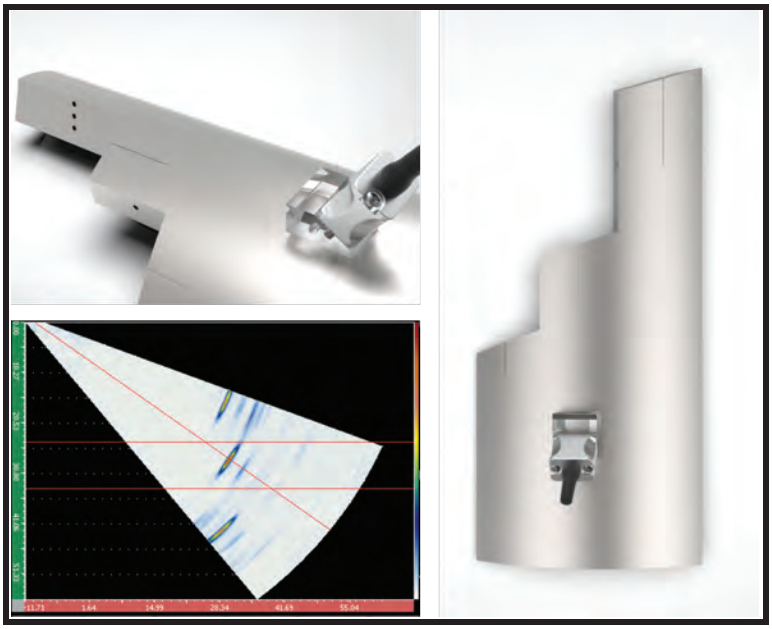

Fig. 1

The blocks have a consistent outside diameter, while providing varying thickness steps on the inside diameter. The OD of each block is machined to span the maximum number of pipe sizes based on ASME criteria. ID thickness steps were customized to span the range of standard pipe schedules. The steps were placed on the ID rather than the OD to maximize usefulness of wedge curvature in accordance with the requirements of T-432.2 introduced in 2017.

Blocks used for establishing DAC/TCG calibrations must provide suitable length and strategically placed reference reflectors to avoid conflicting echoes. The dreaded "split-DAC" is often required on shorter blocks which may result in sudden steps up/down in the TCG curve. To establish uninterrupted DAC/TCG curves, the segment lengths and reflector positions were modeled to control interfering reflections. Also, block ends were strategically angled to deflect termination echoes (see Fig. 1).

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ERVW® Blocks FAQ

Q: Where are the notches?
A: Notches are considered optional in the Alternate Calibration Block for Piping found in ASME Sec V. Art. 4, Figure T-434.3-2 (note b.)

Q: What are the lines on the top of the blocks?
A: These are guidelines indicating the tangential position of the side-drilled holes, confirmed at one half of their length. It is at this point that the hole location, through the wall thickness, is correct at the 1/4T, 1/2T, and 3/4T positions. The essential guidelines are conveniently located on the OD and end of the blocks to aid in calibrating at both short and long sound path distances.

Q: Why side-drilled holes? Why not notches?
A: Paragraph T-464.1.1 states that calibrations shall be performed utilizing the calibration block shown in Figure T-434.3-1 or the alternate provided in Figure T-434.3-2. The ERVW Blocks are based on Figure T-434.3-2, and as mentioned above, notches are optional on this block. Side-drilled holes have certain advantages over notches, including:

- Holes are "omnidirectional" reflectors that reflect sound waves regardless of angle, simplifying TCG calibrations when compared to notches.
- Holes can be used to calibrate wedge delay across all angles.
- Side-drilled hole blocks are not subject to the same minimum 8-inch circumferential arc length as notch blocks, so they can be made smaller and more portable.

Q: The holes appear quite close to the ends of the block. Won't this cause problems with corner reflections when performing a TCG calibration for Phased Array?
A: Compound angles are machined at the end of each step with the aim of redirecting termination echoes. This significantly reduces the problematic corner trap signals when trying to perform a wedge delay or TCG calibration with PAUT on a standard block.

Q: Can these be used for both Phased Array and Conventional Ultrasonic Testing?
A: The ERVW Blocks were specifically designed with PAUT in-mind, however, they work perfectly fine with conventional UT equipment as well.

Q: What is the finish of the blocks like?
A: The goal of all good calibration standards is to accurately represent the surface finish of the item to be inspected. Since these blocks are used for pipeline inspection, the surface finish is typical of pipe and not a smooth, polished finish like an IIW or other standard test block. Surface finish is approximately 125 Ra micro-inches (3.2 Ra micro-meters). In order to prevent premature rusting, we apply a very thin layer of pure nickel, .0003 inch (.0076mm.) This will keep the blocks looking great for years.

Q: How many holes do ERVW Blocks have, and what are the depths (within the wall) of the holes?
A: The ERVW blocks have three side-drilled holes (1/4T, 1/2T, and 3/4T) for thicknesses of 0.750 inch (19mm) and greater, and one hole at the 1/2T location for thicknesses less than 0.750 inch (19mm.) This is in accordance with Fig. T-434.3-2, (note a.)

The hole location, through the wall thickness, is determined at the axial centerline. Note (2) under Fig. T-434.3-2 states that, "the radius of the side-drilled hole shall be added to the measured depth to ensure the correct depth." Practically speaking, this results in moving the centerline of a 3/32 inch (2.5mm) diameter hole downward by 3/64 inch (1.2mm). This moves the top edge of the hole to a precise 1/4T, 1/2T, or 3/4T position but does not provide any advantage for shear wave calibration where the beam reflects from the side of the hole. Additionally, increasing the depth of the hole on thin cross-sections decreases the distance between the bottom edge of the hole and the ID surface of the pipe, reducing the ability to distinguish between the direct echo (1/2T hole) and the echo after the first backwall (1-1/2T hole). The tolerance on hole depth (location within the wall thickness) is ±1/8 inch (3mm) per Fig. T-434.2.1, (note c.) As a result, holes with their centerlines located 1/4T, 1/2T and 3/4T (rather than shifted to adjust for the radius) are code-compliant and optimize the response when calibrating.

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